Sugar Creek Source Identification
Water Quality Study

September 2000

SURVEYS SECTION
ASSESSMENT BRANCH
OFFICE OF WATER QUALITY
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
IDEM 032/02/074/2003

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Water Quality Study

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By
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Compilation and development of the final report was the primary responsibility of the Surveys Section
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Surveys Section
Assessment Branch
Office of Water Quality
Indiana Department of Environmental Management
IDEM 032/02/074/2003
October 2003

Acknowledgements:

The author would like to thank the following staff for their help during this study:
Jim Butler for assistance in equipment preparation and field sampling activities, Tim Bowren for providing the QA/QC data report, Cindy Martin for providing the map of the study area in this report, and Chuck Bell for his assistance in the formatting of this report.

Cover Photo - Sugar Creek at CR 550 N (Site UMI070-0008), facing upstream. Picture was taken on July 20, 1999.

Citation:

Beckman T. 2003. *Sugar Creek Source Identification Water Quality Study September 2000.* Indiana Department of Environmental Management, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, Indiana. IDEM 032/02/074/2003.

Abstract

This source identification study was initiated to ascertain the source(s) of the low dissolved oxygen concentration found in Sugar Creek as a result of a Probabilistic Survey conducted on July 20, 1999. Sugar Creek is situated in the Iroquois River Basin and drains predominately agricultural land in Benton County, Indiana. Extensive reconnaissance of Sugar Creek upstream of the low dissolved oxygen location revealed a raw sewage tile discharge to Sugar Creek approximately 120 yards upstream of Railroad Street/CR 450. The source of this raw sewage discharge is believed to be from the unsewered community of Earl Park, which is situated approximately one mile southeast of this discharge. No dissolved oxygen stream standard violations were noted in any of the samples collected during the current study. It is the opinion of this investigator that the lack of violations was due to the relatively higher stream flow of Sugar Creek that existed during this study as compared to the 1999 sampling. No water quality parameters were found above stream standards in this study, but an elevated ammonia-nitrogen concentration was found in the raw sewage tile discharge to Sugar Creek. This discharge will continue to cause water quality impairments in this segment of Sugar Creek as long as it is allowed to continue. The Benton County Health Department and the Indiana State Department of Health, who are responsible for the regulation of this type of discharge, have been contacted and are continuing their investigation.

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Introduction

Sugar Creek is located in the Iroquois River Basin and flows in a west-southwest direction from north central Benton County to the Indiana/Illinois State line in west central Benton County. Sugar Creek drains predominately agricultural land but has the small town of Earl Park located near the study area. Sugar Creek has a total drainage area within Indiana of 85.1 square miles (Hoggatt 1975). The current Source Identification study was initiated in response to an observed low dissolved oxygen concentration in Sugar Creek at site UMI070-0013 on July 20, 1999. This site was surveyed as a probabilistic site as part of the Watershed Monitoring Program for the Kankakee River Basin in support of the *Surface Water Quality Monitoring Strategy 1996-2000* (IDEM 1998). In addition, field personnel reported a raw sewage smell at the same sample site. This site was located approximately 1 mile northwest of Earl Park, in Benton County.

Methods and Materials

This source identification study was conducted on September 20, 2000, and was limited to that reach of Sugar Creek approximately 1.5 miles upstream and downstream of site UMI070-0013, the location of a low dissolved oxygen concentration identified during the 1999 Probabilistic Study. Five Sugar Creek samples were collected as grabs in addition to one partially submerged field tile discharge to Sugar Creek. General chemistry, nutrient and field data samples were collected at all sample sites during this study. All samples were collected in accordance with the *Surveys Section Field Procedure Manual* (IDEM 2002). Figure 1 presents the study area and Table 1 provides a list of the sampling site location descriptions. In addition, all field data and laboratory parameters collected for this study are presented in Tables 2 and 3.

Table 1 Site Location Descriptions for the Sugar Creek Source Identification Study

Site ID	Stream	Location	Latitude/Longitude
UMI070-0005	Sugar Cr	Spring St/CR 500 W	40? 41' 55"/87? 25' 11"
UMI070-0006	Sugar Cr	Railroad St/CR 450	40? 41' 32"/87? 25' 46"
UMI070-0007	Field Tile	U/S of Railroad St	40? 41' 34"/87? 25' 44"
UMI070-0008	Sugar Cr	7th St/CR 550 N	40? 41' 11"/87? 25' 55"
UMI070-0009	Sugar Cr	CR 600 W	40? 40' 53"/87? 26' 20"
UMI070-0010	Sugar Cr	CR 500 N	40? 40' 44"/87? 26' 29"

Table 2 Field Parameters for the Sugar Creek Source Identification Study

Parameter	Method	Accuracy
Dissolved Oxygen	SM 4500-OG	+/- 0.2 mg/L
Specific Conductance	SM 2510	+/- 1% of range
Temperature	SM 2550	+/- 0.15° Celsius
pH	SM 4500-H	+/- 0.01 SU

Figure 1 Sugar Creek Source ID Study Area

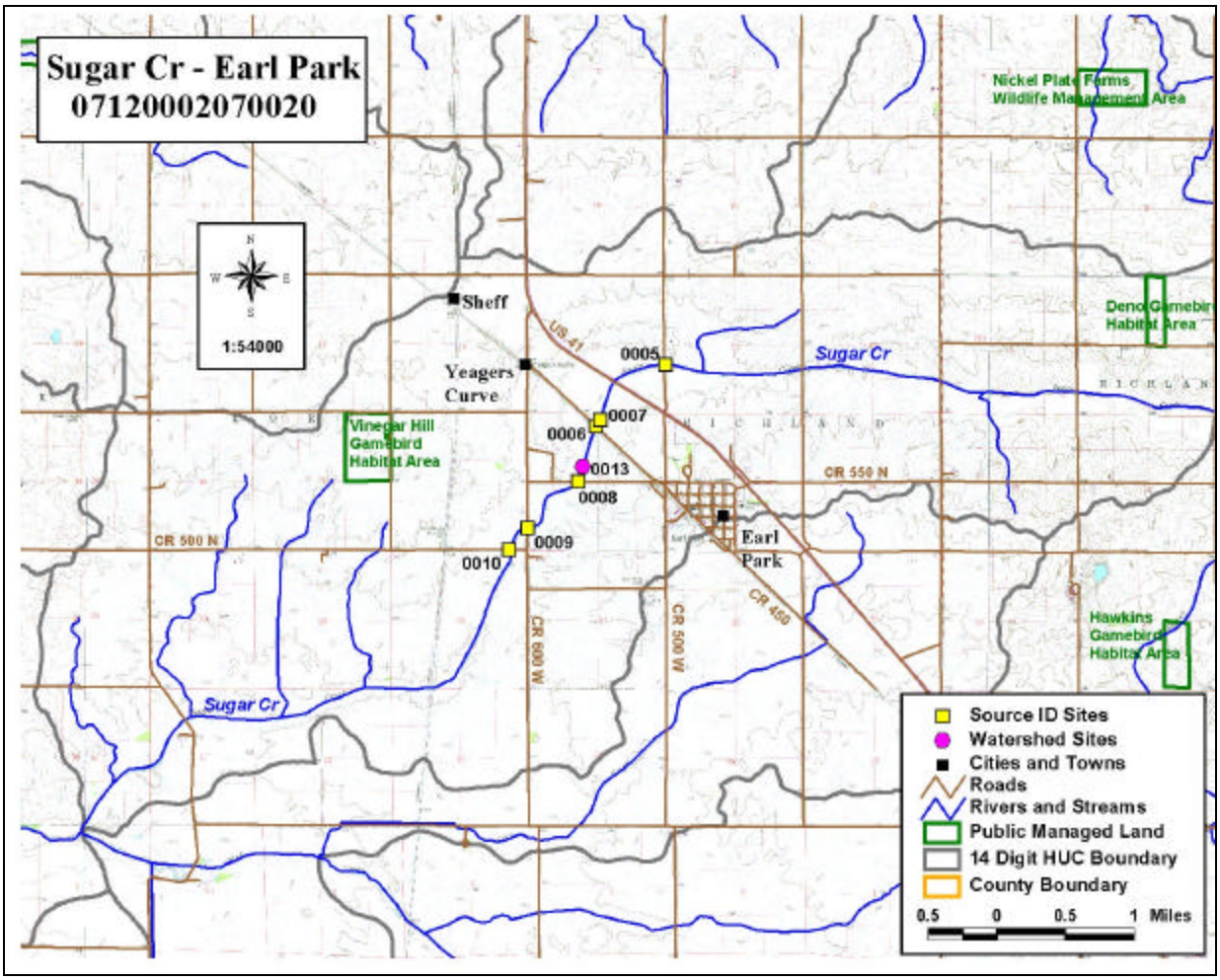

Table 3 Chemical Parameters Analyzed for the Sugar Creek Source Identification Study

Anions/Physical			Nutrients/Organic		
Parameter	**Method**	**MRL[1]**	**Parameter**	**Method**	**MRL**
Alkalinity	310.1	10 mg/L	TKN	351.2	0.10 mg/L
$CBOD_5$	405.1	5.0 mg/L	Ammonia-N	350.1	0.10 mg/L
Total Solids	160.3	7.0 mg/L	Nitrate+Nitrite-N	353.2	0.01 mg/L
Suspended Solids	160.2	4.0 mg/L	Total Phosphorus	356.2	0.03 mg/L
Dissolved Solids	160.1	10 mg/L	TOC	415.1	1.0 mg/L
Sulfate	375.2	5.0 mg/L	COD	410.4	5.0 mg/L
Chloride	325.2	1.0 mg/L			
Hardness	130.1	1.0 mg/L			

[1] Method/Laboratory Reporting Limit

Quality Assurance

Contracting laboratories provide analytical reports to IDEM that contain test results and Quality Control information for each batch of samples submitted by Assessment Branch staff. Quality

assurance and quality control (QA/QC) procedures for this study adhered to the Quality Assurance Project Plan (QAPP) and all field and laboratory data collected for this study met QA/QC requirements for Indiana Surface Water Quality Monitoring Programs of the Assessment Branch (IDEM 1999). A complete copy of the QA/QC report is included as Attachment I. Generally, this plan requires one duplicate and one matrix spike/matrix spike duplicate (MS/MSD) for every ten samples collected in addition to one blank sample for every field trip. This study only required six stream samples so that one duplicate, one MS/MSD, and one blank adequately satisfied QA/QC requirements. Stream samples and field data are also required to meet Data Quality Assessment levels cited in the QAPP for Indiana Surface Water Quality Programs.

Results and Discussion

In the course of the inspection of the study area, a discharge to Sugar Creek from a partially submerged tile was discovered approximately 120 yards upstream of Railroad Street/CR 450. Physical observations indicated that the discharge contained raw sewage. It is believed that the pipe discharges sewage from homes in the area and especially from the town of Earl Park. Filamentous sewage fungus was observed on the inside of this pipe. This growth indicates a relatively longer-term discharge of sewage the result of which likely caused the low dissolved oxygen levels found downstream in Sugar Creek during the 1999 sampling event.

Sampling results, as presented in Table 4 and Table 5 below, did not identify any Indiana Stream Standards violations. Elevated ammonia-nitrogen concentrations were found in the raw sewage discharges to Sugar Creek. In addition, a relatively high phosphorus concentration was analyzed in the tile discharge. All dissolved oxygen concentrations recorded in Sugar Creek were above the minimum stream standard of 4.0 mg/L, which was attributed to the somewhat higher flow of Sugar Creek as compared to the 1999-sampling event.

Table 4 Field Data Results for the Sugar Creek Source Identification Study

Site	Date	Time	Dissolved Oxygen (mg/L)	PH (SU)	Temp. (°C)	Spec. Con. (? S/cm)	Dissolved Oxygen % Sat
UMI070-0005	9/20/00	12:30 PM	12.06	8.38	22.09	670	148.7
UMI070-0006	9/20/00	1:35 PM	9.14	8.06	18.95	715	101.2
UMI070-0007	9/20/00	1:15 PM	4.54	7.95	18.64	1098	49.9
UMI070-0008	9/20/00	1:55 PM	6.36	7.95	19.27	697	70.6
UMI070-0009	9/20/00	2:30 PM	8.14	8.05	18.55	679	89
UMI070-0010	9/20/00	2:40 PM	9.22	8.17	18.61	678	101.6

Quality Assurance/ Quality Control

Data Quality

IDEM chemists from the Toxicology and Chemistry Section, Assessment Branch, OWQ reviewed lab data reports from samples for the Sugar Creek Source Identification Water Quality Study for compliance to the Surface Water QAPP requirements for Quality Assurance / Quality Control (QA/QC).

Precision

The in-field and in-lab quality assurance for data in this report for precision was based on field duplicates, laboratory duplicates, matrix spike duplicates, and Relative Percent Difference (RPD). RPDs for almost all the parameters were within control limits (+/- 20%), but a high RPD in the field duplicate comparison was noted for Phosphorus. This result was flagged as estimated.

Accuracy

The in-lab analytical accuracy was based on matrix spikes, matrix spike duplicates, quality control samples, and on-going performance recovery samples. The recovery values for Chemical Oxygen Demand (COD) were below acceptable limits and all the results were estimated.

Holding Times

Laboratory holding times for all the parameters except Hardness were within acceptable limits per Table 2 in 40 CFR part 136. Hardness exceeded acceptable holding times and the results were rejected.

Blanks

Significant results, greater than the MRL, for a parameter indicates contamination from the field sampling process (field blanks) or laboratory sample preparation (field blanks or lab blanks). Blank contamination of Nitrogen, Ammonia was noted for this project. Affected results were flagged either as accepted or rejected depending upon the level of contamination.

Of the 84 results gathered for this project, 11.9% (10) were rejected and 8.3% (7) were qualified as estimated. As per the Surface Water QAPP, the non-rejected data was qualified at Data Quality Assessment Level 3 and acceptable for use in IDEM decision making processes. Rejected data was not used for assessment purposes. Details of the Quality Assurance Analysis are included in Attachment I.

Table 5 Laboratory Sample Results for the Sugar Creek Source Identification Study

	Sample Sites					
Parameter	**UMI070-0005**	**UMI070-0006**	**UMI070-0007**	**UMI070-0008**	**UMI070-0009**	**UMI070-0010**
Alkalinity (mg/L)	220	240	360	240	230	220
Chloride (mg/L)	19	25	97	25	23	23
Chemical Oxygen Demand (mg/L)	10	12	58 J	14	<1.0 J	8.3 J
Nitrogen, Ammonia (mg/L)	<0.1 B		14.3 B			
Nitrogen, Total Kjeldahl (mg/L)	0.16	0.38	16	0.42	0.23	0.23
Nitrogen, Nitrate+Nitrite (mg/L)	0.42	0.5	0.33	0.47	0.62	0.58
Phosphorus, Total (mg/L)	0.053	0.11 DJ	2.2	0.12	0.084	0.087
Solids, Total Dissolved (mg/L)	430	460	560	440	440	430
Solids, Total Suspended (mg/L)	7	10	18	17	7	6
Solids, Total (mg/L)	440	470	600	470	440	440
Sulfate (mg/L)	94	87	53	92	61	79
Total Organic Carbon (mg/L)	2	2.1	10	2.8	2.1	2.1
Biochemical Oxygen Demand, Carbonaceous 5-day (mg/L)	7.2	6.4	18	10	3.1	2.4

Summary and Conclusions

Although the sampling results of this study did not reveal any dissolved oxygen concentrations below stream standards as in the 1999 sampling, the raw sewage discharge to Sugar Creek was the likely source of the low dissolved oxygen concentration observed in Sugar Creek on July 20, 1999. This discharge will continue to cause water quality impairments in this reach of Sugar Creek until it is removed. The town of Earl Park is an unsewered community without a wastewater treatment plant. The Benton County Health Department and the Indiana State Department of Health, who are responsible for the regulation of this type of discharge, have been informed of the results of the current study and are continuing their investigation.

References

Hoggatt RE. 1975. *Drainage Areas of Indiana Streams.* In cooperation with the United States Geological Survey (USGS) and the Indiana Department of Natural Resources (IDNR). U.S. Government Printing Office.

Indiana Department of Environmental Management (IDEM). 1998. *IDEM Surface Water Quality Monitoring Strategy 1996-2000*. Assessment Branch, Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana. IDEM/32/01/013. May 1998.

Indiana Department of Environmental Management (IDEM). 1999. *Quality Assurance Project Plan for Indiana Surface Water Quality Monitoring Programs. Rev 2.* Assessment Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana. IDEM/32/01/1442/1999. June 1999.

Indiana Department of Environmental Management (IDEM). 2002. *Water Quality Surveys Section Field Procedure Manual.* Surveys Section, Assessment Branch, Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana. April 2002.

Attachment I

Quality Assurance of Analytical Data for
Water Samples from the Source Identification
Sampling Dates: 9/27/2000

Environmental Toxicology and Chemistry Section, AB/OWM
QA/QC Review Report: IDEM/100/29/477/002/2001

IDEM Sample Set # 00WQW226

Sample Identification and Sampling Locations

	SampleID	TA Sample No.	Sample Type	Date Sampled	Site Name	River/Stream/Creek/Lake	Sample Location	County
1	AA02259	276510	Normal	9/27/00	UMK050-0022	Dausman Ditch	SR 19	Kosciusko
2	AA02260	276511	Field Blank	9/27/00	BLANK		Dummy Site for Blanks	
3	AA02261	276512	MS/MSD	9/27/00	UMK050-0023	Jacob B. Miller Field Tile	combined with the Mikel	Kosciusko
4	AA02262	276513	Normal	9/27/00	UMK050-0008	Dausman Ditch	D/S of SR 19	Kosciusko
5	AA02263	276515	Normal	9/27/00	UMK050-0025	Dausman Ditch	CR 900 West	Kosciusko
6	AA02265	276516	Normal	9/27/00	UMK050-0027	Dausman Ditch	CR 1100 West	Marshall
7	AA02266	276517	Duplicate	9/27/00	UMK050-0027	Dausman Ditch	CR 1100 West	Marshall

Testing Laboratory:

Test America Incorporated (TA)
Indianapolis Division
6964 Hillsdale Ct.
Indianapolis, IN 46250

Contact Person:
[] Ken Busch
[] Telephone: 317-842-4261

Sample Receipt Date to TA: 9/28/2000 **Date Report Prepared: 12/14/2000**
TA Job Number (s): 00.05208 **Date Report Received: 1/3/2001**

Chain of Custody: A check mark [Y] below indicates information about each item is complete and acceptable.

[] Sampler Signature Y	[] Custodian Signature Y	[] Collection Time(s) Y
[] Collection Date(s) Y	[] Receiving Time(s) Y	[] Receiving Date(s) Y
[] Preservatives Y	[] Containers Y	

General Chemistries

Test Methods and Reporting Limits (mg/L unless otherwise noted)

PARAMETERS:	TEST METHODS	IDEM REPORTING LIMITS	TA REPORTING LIMITS
Alkalinity	310.1	10	10
Chloride	325.2	1.0	1.0
Chemical Oxygen Demand (COD)??	410.4	3.0	5.0
Hardness (as $CaCO_3$)	130.1	1.0	1.0
Nitrogen, Ammonia	350.1	0.01	0.10
Nitrogen, Total Kjeldahl (TKN)????	351.2	0.05	0.10
Nitrogen, Nitrate+Nitrite	353.2	0.01	0.01
Phosphorus, Total	365.2	0.01	0.03
Solids, Dissolved (TDS)	160.1	10	10
Solids, Suspended (TSS)????????	160.2	4.0	4.0
Solids, Total (TS)	160.3	1.0	7.0
Sulfate	375.2	1.0	5.0
Total Organic Carbon (TOC)	415.1	1.0	1.0

Quality Control (QC) Checks and Compliance: A check mark [Y] below indicates information about each QC criterion is complete and acceptable.

[] Summary Data Package Y
[] Prep Dates Y
[] Analysis Dates Y
[] Holding Times Y
[] Approved Analytical Methods Y
[] Approved Detection Limits Y
[] Method, Field, and Trip Blanks (< CRQL) Y
[] Field and Method Duplicates (RPD $\leq$ 20%) Y
[] Matrix Spikes and Matrix Spike Duplicates ($\pm$ 20%; RPD $\leq$ 20%) Y
[] Instrument Calibrations (Correlation Coefficient $\geq$ 0.995) Y
[] Laboratory Control Standards ($\pm$ 20%) Y
[] Initial and Continuing Calibration Verification Standards ($\pm$ 10%) Y

Comments: See Below

IDEM ID	Parameter(s)	Data Flag(s)	Action
AA02259, AA02260, AA02261, AA02262, AA02263, AA02265, AA02266	Nitrogen, Nitrate+Nitrite (1)	B A	Accepted
AA02259, AA02261, AA02263, AA02265, AA02266	Nitrogen, Total Kjeldahl (TKN) (2)	B R	Rejected
AA02262	Nitrogen, Total Kjeldahl (TKN) (3)	B J	Estimated
AA02266, AA02260	Nitrogen, Nitrate+Nitrite (4)	H J	Estimated
AA02259, AA02260, AA02261, AA02262, AA02263, AA02265, AA02266	Chloride (5)	J	Estimated

(1) This parameter was found in lab blank at .012 mg/L. All of the samples that are below the reporting limit and above .12 mg/L will be accepted.
(2) This parameter was found in field blank at .24 mg/L. All of the samples that are above the reporting limit and below 1.2 mg/L will be rejected.
(3) This parameter was found in field blank at .24 mg/L. All of the samples that between 1.2 mg/L and 2.4 mg/L will be estimated
(4) The analysis for this parameter was performed out of the holding time of 28 days.The analysis was preformed before the 42 day and will be estimated.
(5) The MS/MSD recovery values were below the acceptable limits. The matrix interference may be suppressing the analyte recovery. The concentration values for the sample may be biased low due to the suspected matrix interference. The concentration values for the sample may be biased low due to the suspected matrix interference. Therefore this set will be considered estimated.

Data Qualifiers and Flags

R: Rejected

J: Estimated.

Q: One or more of the QC checks or criteria was out of control.

H: The analysis for this parameter was performed out of the holding time. The results will be estimated or rejected on the basis listed below:

1) If the analysis was performed between the holding time and 1½ times the holding time the result will be estimated.

2) If the analysis was performed outside the 1½ times the holding time window the result will be rejected.

D: The Relative Present Difference (RPD) for this parameter was above the acceptable control limits. The parameter will be considered estimated or rejected on the basis listed below:

1) If the RPD is between the established control limits and two times the established control limits then the sample will be estimated.

2) If the RPD is twice the established control limits then the sample will be rejected.

B: This parameter was found in field or lab blank. Whether the result is accepted, estimated, or rejected will be based upon the level of contamination listed below.

1) If the result of the sample is greater than the reporting limit but less than five times the blank contamination the result will be rejected.

2) If the result of the sample is between five and ten times the blank contamination the result will be estimated

3) If the result of the sample is less than the reporting limit or greater than ten times the blank contamination the result will be accepted.

U: The result of the parameter is above the Method Detection Limit (MDL) but below the reporting limit and will be estimated.

Data Quality Assessments (DQAs): A check mark [Y] below indicates the DQA Level to which the analytical data qualifies.

Level 1 [] **Screening data:** The results are usually generated onsite and have no QC checks. Analytical results, which have no QC checks or no precision or accuracy information or no detection limit calculations, but just numbers, are included in this category. Primarily, onsite data are used for presurveys and for preliminary rapid assessment.

Level 2 [] **Field analysis data:** Data is recorded in the field or laboratory on calibrated or standardized equipment. Field duplicates are measured on a regular periodic basis. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been set for each analysis. The QC checks information for field or laboratory results is useable for estimating precision, accuracy, and completeness for the project. Data from this category is used independently for rapid assessment and preliminary decisions.

Level 3 [Y] **Laboratory analytical data:** Analytical results include QC check samples for each batch of samples from which precision, accuracy, and completeness can be

determined. Detection limits have been determined using 40 CFR Part 136 Appendix B, Revision 1.11. Raw data, chromatograms, spectrograms, and bench sheets are not included as part of the analytical report, but are maintained by the Contract Laboratory for easy retrieval and review. Data can be elevated from level 3 to level 4 by the inclusion of this information in the report. In addition, level 4 QC data must be reported using CLP forms or CLP format. Data falling under this category is considered as complete and is used for regulatory decisions.

Level 4 [] **Enforcement data:** Analytical results mostly meet the USEPA required Contract Laboratory Program (CLP) data analysis, contract required quantification limits (CRQL), and validation procedures. QC data is reported on CLP forms or CLP format. Raw data, chromatograms, spectrograms, and bench sheets are included as part of the analytical report. Additionally, all reporting information required in the IDEM/BAA and in the Surface Water QAPP Table 11-1 are included. Data is legally quantitative in value, and is used for regulatory decisions.

Compliance Statement:

The laboratory results for a Data package from **7 water** samples received from Test America (TA) were reviewed for compliance with IDEM BAA 97-44, dated 4/18/97 and OWM QAPP (Rev. 2, June 1999) for Indiana Surface Water Programs.

Summary and Conclusions:

1. Data Quality Assessment Level: 3
2. Level of Completeness: 100%

The data for the **7 water** samples from data package **00WQW226** has been assigned to Data Quality Assessment (DQA) Level 3 of QAPP for Indiana Surface Water Programs. The analytical results for **7 water** samples appear acceptable and could be used for OWM decision making.

Reviewed by:
Signature: _Christopher Haynes_____ Title: Chemist_____ Date: January 3, 2001
Original signature on file
Approved by:
Signature: _Dr. Syed GhiasUddin___ Title: QA/Coordinator____ Date: _____
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